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LIGHTING TECHNOLOGIES: A GUIDE TO ENERGY-EFFICIENT ILLUMINATION

Lighting accounts for about 20 percent of the average home's electricity use. It pays to know which types of lighting are most energy-efficient and some of the pros and cons of each. Though this guide is not exhaustive, it may serve as a reference point when choosing between the more common home lighting technologies.

LIGHTING TECHNOLOGIES

Compact Fluorescent Lamps (CFLs) have been available for residential use for about 30 years, with recent advances increasing their quality and popularity. They are the most energy-efficient choice for homes today. CFLs come in screw-in or pin-based configurations, in many sizes and shapes. Screw-in lamps fit into almost any fixture that accepts standard bulbs. Pin-based CFLs plug directly into a dedicated energy-efficient fixture. All indoor and most outdoor ENERGY STAR® qualified light fixtures are designed to accept only pin-based CFLs. CFLs last longer and use fewer watts than incandescent and halogen lamps to provide the same amount of light. They operate at a low temperature and come in 'warm' and 'cool' colors. Most CFLs do not operate well on remote or dimmer switches. Because CFLs contain mercury, they should always be disposed of properly. The best option is to recycle them. If recycling is not an option, place the burned out CFL in a sealed plastic bag and dispose with your local municipal solid waste as you do batteries.

Initial Cost:	Medium	Color Rendering Ability:	Medium-High
Energy Consumption:	Low	Operating Temperature:	Low
Lifetime:	High		

Incandescent Lamps are the "standard" light bulb invented more than 125 years ago by Thomas Edison. They have the lowest initial cost and good color rendering. Incandescents typically have short life spans and use more watts than CFLs and halogen lamps to produce the same lumens, or light output. Ninety percent of the energy used by an incandescent light bulb escapes as heat, with the remaining 10% producing light. Incandescents are the most commonly found bulbs in American homes.

Initial Cost:	Low	Color Rendering Ability:	High
Energy Consumption:	High	Operating Temperature:	Medium-High
Lifetime:	Low		

Halogen Lamps are somewhat more efficient than incandescent lamps, but operate at a higher lamp temperature. These high operating temperatures can present a safety concern in some fixtures, such as torchiere floor lamps that require 200-300 watts. Halogens are often used for recessed, accent, and flood lighting.

Initial Cost:	Medium	Color Rendering Ability:	High
Energy Consumption:	Medium-High	Operating Temperature:	High
Lifetime:	Medium		

Linear Fluorescent Lamps are most often used in residential garages and basements for general lighting. They are highly efficient and long-lasting. More stylish fixtures that use this technology can be found for use indoors, such as for kitchen ceiling lights.

Initial Cost:	Low-Medium	Color Rendering Ability:	Medium-High
Energy Consumption:	Low	Operating Temperature:	Low
Lifetime:	High		

Light Emitting Diodes (LEDs) have recently become commercially available as a lighting source. They have extremely long life spans, are moderately energy efficient, and come in a variety of colors. As research continues, LEDs continue to improve and be used in new applications. An increasingly popular residential use is holiday lights. Colored LEDs are now commonly used commercially in exit signs and traffic signals, which can significantly reduce maintenance costs. While LED technology is being explored for common residential use, technical and cost barriers remain. However, the ENERGY STAR program is planning to add holiday lights to the list of product types that can earn the label and is exploring bulbs and fixtures for the future.

Initial Cost:	High	Color Rendering Ability:	Low - Medium
Energy Consumption:	Medium	Operating Temperature:	Low
Lifetime:	High		

WHAT IS A BALLAST?

A ballast is a device that serves to control the flow of power to a fluorescent lamp. Advanced electronic ballasts are replacing magnetic ballasts of the past in new CFL bulbs and fixtures. Electronic ballasts eliminate the “hum” and visible flickering found in older fluorescent technology and improve dimming and daylight controls.

COMPARING DIFFERENT LIGHTING TECHNOLOGIES

The table below summarizes some key criteria for evaluating different lighting technologies.

Technology	CRI	Efficacy (lumen/W)	Lifetime (hrs)	Color Temperature (K)
Compact Fluorescent	82-84	60-70	6,000 - 10,000	2700-2800
Incandescent	100	12-18	750-2,500	2,800
Tube Fluorescent	84	92	20,000	3,000
Halogen	100	16-29	2,000-3,500	3,050
White LED	65	22	10,000-25,000	-

+ **Color Rendering Index (CRI)** is a measurement of a light source’s ability to recreate the colors of an incandescent light source with a similar color temperature. Sunlight and most incandescent lamps have CRIs defined as 100, so 100 serves as the standard. Only compare CRI of light sources at the same color temperature.
+ **Efficacy** is a measure of light output (lumens) per watt of electrical power needed by the lamp. Lumens measure how much light is emitted. Watts indicate how much electrical power is required.
+ **Color Temperature** is a way to compare the light color from different types of lamps. It is not related to the operating temperature of the lamp, but is often referenced as cool or warm light. Incandescent lamps and candles give off warm color temperatures, while sunlight and some fluorescents emit cool color temperatures.

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